

How wireless networks scale: the illusion of spectrum scarcity

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Abstract:

As wireless networking becomes a more and more important radio application, it is becoming clear that our current means of allocating radio communications resources cannot satisfy our future need for increasingly dense, fast, flexible, and mobile communications networks. "Spectrum scarcity" is the apparent result, and many economists and regulators have proposed innovative means to allocate such scarce resources to the most important uses.

Before solving the problem, however, it is important to determine whether the spectrum problem is a fundamental problem, or merely an accident of architecture.

In this talk, we will argue that the spectrum problem is a problem that results from architectures that do not scale well. In particular, the problem is network architectures that do not scale efficiently as their applications grow. That is, there is reason to believe that the spectrum problem is not primarily a regulatory or economic problem to be solved by policymakers, but is rather a technical problem that must be solved before policies and economic models can be sorted out.

We'll examine approaches to radio network scaling, and visit what is known about the limits to scaling of radio networks, pointing out that some fundamental issues are open research questions.

Since our approach to spectrum use in communications matured in the 1930's, seventy years ago, and twenty years before Shannon did his pioneering work, it is not surprising that our current technical capabilities and application needs would require a fundamental rethinking of architectures.

In conclusion, we'll propose an agenda for research and policy exploration based in this insight.